

Appl. No. 10/749,103

Docket No. MIT-136BUS

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

Please cancel Claims 1-27.

- 1 28. (Original) A method of providing a multi-layer semiconductor structure, the
2 method comprising:
3 providing a first semiconductor structure having first and second opposing
4 surfaces; and
5 disposing a laminate layer over a first one of the first and second opposing
6 surfaces of the first semiconductor structure to provide a first semiconductor structure
7 having a laminate layer disposed thereon.
1
1 29. (Original) The method of claim 28 further comprising:
2 disposing a handle member over the laminate layer.

1 30. (Original) The method of claim 29 further comprising:
2 a substrate on a second one of the first and second opposing surfaces of the first
3 semiconductor structure.

1 31. (Original) The method of claim 30 further comprising:
2 removing at least a portion of the substrate from the second one of the first and
3 second opposing surfaces of the first semiconductor structure to provide a
4 semiconductor-handle complex.

1 32. (Original) The method of claim 31 further comprising:
2 providing a second semiconductor structure); and
3 aligning a first surface of the semiconductor-handle complex with a first surface
4 of the second semiconductor structure.

Appl. No. 10/749,103

Docket No. MIT-136BUS

1 33. (Original) The method of claim 32 further comprising:
2 bonding the first surface of the second semiconductor structure to the first surface
3 of the semiconductor -handle complex.

1 34. (Original) The method of claim 33 further comprising:
2 removing the handle member and the laminate layer.

1 35. (Original) The method of claim 28 wherein providing a first semiconductor
2 structure having first and second opposing surfaces comprises:
3 a substrate having first and second opposing surfaces; and
4 a first semiconductor structure over a first one of the first and second surfaces of
5 the substrate.

1 36. (Original) The method of claim 28 wherein providing a first semiconductor
2 structure having first and second opposing surfaces comprises:
3 providing a semiconductor structure comprised of a plurality of thin film
4 semiconductor layers.

1 37. (Original) The method of claim 29 wherein disposing a handle member over
2 the laminate layer comprises:
3 providing a handle substrate;
4 disposing a film layer over at least one surface of the handle substrate.

1 38. (Original) The method of claim 37 wherein the film layer is provided from
2 one of: silicon nitride; and silicon dioxide.

1 39. (Original) The method of claim 38 further comprising disposing a laminate
2 over a surface of the handle member.

1 40. (Original) The method of claim 29 wherein disposing a handle member over
2 the laminate layer comprises disposing a handle member over the laminate layer such

Appl. No. 10/749,103

Docket No. MIT-136BUS

3 that a surface of the laminate adheres to a surface of the handle member.

1 41. (Original) The method of claim 29 wherein disposing the laminate layer over
2 a first one of the first and second opposing surfaces of the first semiconductor structure to
3 provide a semiconductor structure having a laminate layer disposed thereon comprises
4 providing a laminate layer comprised of a plurality of layers.

1 42. (Original) The method of claim 41 wherein providing a laminate layer
2 comprised of a plurality of layers comprises:
3 providing a first layer corresponding to a release layer;
4 providing a second layer corresponding to a metal adhesion / diffusion barrier
5 layer; and
6 providing a third layer corresponding to a fusion layer.

1 43. (Original) The method of claim 42 wherein the release layer comprises at
2 least one of zirconium and aluminum.

1 44. (Original) The method of claim 42 wherein the metal adhesion / diffusion
2 barrier layer comprises tantalum.

1 45. (Original) The method of claim 42 wherein the fusion layer comprises at least
2 one of copper; a polymer; and an inorganic dielectric.

1 46. (Original) The method of claim 41 wherein providing a laminate layer
2 comprised of a plurality of layers comprises:
3 providing a first layer corresponding to a metal adhesion / diffusion barrier layer;
4 providing a second layer corresponding to a release layer; and
5 providing a third layer corresponding to a fusion layer.

1 47. (Original) The method of claim 46 wherein the release layer comprises at
2 least one of zirconium and aluminum.

Appl. No. 10/749,103

Docket No. MIT-136BUS

1 48. (Original) The method of claim 46 wherein the metal adhesion / diffusion
2 barrier layer comprises tantalum.

1 49. (Original) The method of claim 46 wherein the fusion layer comprises at least
2 one of copper; a polymer; and an inorganic dielectric.

1 50. (Original) The method of claim 41 wherein providing a laminate layer
2 comprised of a plurality of layers comprises providing a laminate layer comprised of two
3 layers with a first one of the layers corresponding to a release layer and second one of the
4 layers corresponding to one of:

5 a polymer having an adhesive characteristic which allows the laminate layer to
6 adhere to the surface of the thin film semiconductor structure;
7 an inorganic material; and
8 copper.

1 51. (Original) The method of claim 28 wherein disposing a laminate layer
2 comprises providing a laminate layer comprised of a single layer having an adhesive
3 characteristic which allows the laminate layer to adhere to the surface of the
4 semiconductor structure and having a characteristic such that the layer releases from the
5 surface of the semiconductor structure in response to being exposed to a release agent.

1 52. (Original) The method of claim 29, wherein disposing a laminate layer
2 comprises providing a laminate layer comprised of a single layer having an adhesive
3 characteristic which allows the laminate layer to adhere to a surface of the handle
4 member and having a characteristic such that the layer releases from the surface of the
5 semiconductor structure in response to being exposed to a release agent.

1 53. (Original) The method of claim 31, wherein removing the substrate from the
2 second one of the first and second opposing surfaces of the semiconductor structure to
3 provide a semiconductor-handle complex comprises removing a portion of the second

Appl. No. 10/749,103

Docket No. MIT-136BUS

4 surface of the semiconductor-handle complex using at least one of: a mechanical
5 grindback, an aqueous chemical etch; a vapor chemical etch; and a plasma etch.

1 54. (Original) The method of claim 33, wherein bonding the first surface of the
2 second semiconductor structure to the first surface of the semiconductor-handle complex
3 comprises providing bonding pads on at least one of the first surface of the second
4 semiconductor structure; and the first surface of the semiconductor-handle complex.

1 55. (Original) The method of claim 54, wherein the bonding pads are provided
2 from at least one of: copper; a polymer; and an inorganic dielectric.

1 56. (Original) The method of claim 34 wherein removing the handle member and
2 the laminate layer comprises using at least one of:

3 an aqueous-activated method;
4 a vapor-activated method;
5 a light-activated method;
6 a temperature-activated method;
7 an ion bombardment-activated method;
8 an electrically-assisted method; and
9 a mechanical method.

1 57. (Original) The method of claim 28 wherein the semiconductor structure
2 corresponds to a die-to-die semiconductor structure.

1 58. (Original) The method of claim 28 wherein the semiconductor structure
2 corresponds to a die-to-wafer semiconductor structure.

1 59. (Original) The method of claim 28 wherein the semiconductor structure
2 corresponds to a wafer-to-wafer semiconductor structure.

1 60. (Original) The method of claim 28 wherein:

Appl. No. 10/749,103

Docket No. MIT-136BUS

2 providing a first semiconductor structure having first and second opposing
1 surfaces comprises providing a first semiconductor structure having a face surface and a
2 backside surface; and
3 disposing a laminate layer comprises disposing a laminate layer over the face of
4 the first semiconductor structure to provide a semiconductor structure having a laminate
5 layer disposed thereon.

1 61. (Original) The method of claim 32 wherein:
2 providing a second semiconductor structure comprises providing a second thin
3 film semiconductor structure; and
4 aligning a first surface of the semiconductor-handle complex with a first surface of the
5 second semiconductor structure comprises aligning the backside of the semiconductor-handle
6 complex with a face of the second thin film semiconductor structure.

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1 62. (Original) The method of claim 1 wherein:
2 the first semiconductor structure corresponds to an original semiconductor
3 substrate;
4 the first semiconductor-handle complex having a substrate portion corresponds to
5 an original-handle complex having a substrate portion;
6 the handle-semiconductor complex corresponds to a handle-thin film complex;
7 the second semiconductor structure corresponds to a second substrate.

1 63. (Original) The method of claim 62 wherein:
2 the original semiconductor substrate corresponds to a first thin-film substrate
3 the second substrate corresponds to a second thin-film substrate.

1 64. (Original) A method of providing a multi-layer semiconductor structure, the
2 method comprising:
3 providing a handle member having first and second opposing surfaces; and
4 disposing a laminate over a first one of the first and second opposing surfaces of
5 the handle member to provide a handle member having a laminate disposed thereon.

Appl. No. 10/749,103

Docket No. MIT-136BUS

1 65. (Original) The method of claim 64 further comprising:
2 providing a first semiconductor structure; and
3 attaching the laminate to a surface of the first semiconductor structure to provide a
4 first semiconductor structure having a handle member coupled thereto.

1 64, ~~66~~. (New) A multi-layer semiconductor structure comprising:
2 a first semiconductor structure having first and second opposing surfaces; and
3 a laminate layer over one of the first and second opposing surfaces of the first
4 semiconductor structure to provide a first semiconductor structure having a laminate layer
5 disposed thereon.

1 ~~65~~, ~~67~~. (New) The structure of claim ~~64~~ ~~66~~ further comprising a handle member disposed
2 over the laminate layer.

1 ~~66~~, ~~68~~. (New) The structure of claim ~~64~~ ~~66~~ further comprising a substrate disposed on a
2 second one of the first and second opposing surfaces of the first semiconductor structure.

1 ~~67~~, ~~69~~. (New) The structure of claim ~~64~~ ~~66~~ wherein the first semiconductor structure
2 comprises a plurality of thin film semiconductor layers.

1 ~~68~~, ~~70~~. (New) The structure of claim ~~65~~ ~~67~~ further comprising a film layer disposed over at
2 least one surface of the handle member.

1 ~~69~~, ~~71~~. (New) The structure of claim ~~68~~ ~~70~~ wherein the film layer is provided from one of:
2 silicon nitride; and silicon dioxide.

1 ~~70~~, ~~72~~. (New) The structure of claim ~~68~~ ~~70~~ further comprising a laminate disposed over a
2 surface of the handle member.

1 ~~71~~, ~~73~~. (New) The structure of claim ~~64~~ ~~66~~ wherein said laminate layer comprises:
2 a first layer corresponding to a release layer;

Appl. No. 10/749,103

Docket No. MIT-136BUS

- 3 a second layer corresponding to a metal adhesion / diffusion barrier layer; and
4 a third layer corresponding to a fusion layer.

1 ~~72, 74.~~ (New) The structure of claim ~~71 73~~ wherein the release layer comprises at least one of
2 zirconium and aluminum.

1 ~~73, 75.~~ (New) The structure of claim ~~72 74~~ wherein the metal adhesion / diffusion barrier
2 layer comprises tantalum.

1 ~~74, 76.~~ (New) The structure of claim ~~73 75~~ wherein the fusion layer comprises at least one
2 of copper, a polymer; and an inorganic dielectric.

1 ~~75, 77.~~ (New) The structure of claim ~~64 66~~ wherein said laminate layer comprises:
2 a first layer corresponding to a metal adhesion / diffusion barrier layer;
3 a second layer corresponding to a release layer; and
4 a third layer corresponding to a fusion layer.

1 ~~76 78.~~ (New) The structure of claim ~~75 77~~ wherein the release layer comprises at least one
2 of zirconium and aluminum.

1 ~~77, 79.~~ (New) The structure of claim ~~76 78~~ wherein the metal adhesion / diffusion barrier
2 layer comprises tantalum.

1 ~~78, 80.~~ (New) The structure of claim ~~77 79~~ wherein the fusion layer comprises at least one of
2 copper; a polymer; and an inorganic dielectric.

1 ~~79, 81.~~ (New) The structure of claim ~~64 66~~ wherein said laminate layer comprises two layers
2 with a first one of the layers corresponding to a release layer and second one of the layers
3 corresponding to one of:
4 a polymer having an adhesive characteristic which allows the laminate layer to adhere
5 to the surface of the thin film semiconductor structure;

Appl. No. 10/749,103

Docket No. MIT-136BUS

6 an inorganic material; and
7 copper.

1 ~~80. 82.~~ (New) The structure of claim ~~64 66~~ wherein said laminate layer comprises a single
2 layer having an adhesive characteristic which allows the laminate layer to adhere to the
3 surface of the semiconductor structure and having a characteristic such that the layer releases
4 from the surface of the semiconductor structure in response to being exposed to a release
5 agent.

1 ~~81. 83.~~ (New) The structure of claim ~~64 66~~ wherein the semiconductor structure corresponds
2 to a die-to-die semiconductor structure.

1 ~~82. 84.~~ (New) The structure of claim ~~64 66~~ wherein the semiconductor structure corresponds
2 to a die-to-wafer semiconductor structure.

1 ~~83. 85.~~ (New) The structure of claim ~~64 66~~ wherein the semiconductor structure corresponds
2 to a wafer-to-wafer semiconductor structure.

1 ~~84. 86.~~ (New) The structure of claim ~~64 66~~ wherein a portion of the substrate from the second
2 one of the first and second opposing surfaces of the first semiconductor structure and the
3 handle member provide a semiconductor-handle complex and wherein the structure further
4 comprises:

5 a second semiconductor structure corresponding to a second thin film semiconductor
6 structure disposed over a first surface of the semiconductor-handle complex with a first
7 surface of the second thin film semiconductor structure aligned with a backside of the
8 semiconductor-handle complex.

1 ~~85. 87.~~ (New) The structure of claim ~~84 86~~ wherein:
2 the first semiconductor structure corresponds to an original semiconductor substrate;
3 the first semiconductor-handle complex having a substrate portion corresponds to an
4 original-handle complex having a substrate portion;

Appl. No. 10/749,103

Docket No. MIT-136BUS

5 the handle-semiconductor complex corresponds to a handle-thin film complex; and
6 the second semiconductor structure corresponds to a second substrate.

1 ~~86. 88.~~ (New) The structure of claim ~~85~~ 87 wherein the original semiconductor substrate
2 corresponds to a first thin-film substrate.